

## Title

<i>Experiment</i>	ICECUBE
<i>Name of Proposal</i>	ICECUBE

## Physics Goals

### *Measurement*

- Detection of "atmospheric neutrinos"
- Detection of UHE neutrinos of non-terrestrial origin
- Detection of SN neutrino bursts
- Detection of GRB neutrino bursts
- Survey of the "neutrino sky" at all energies

### *Discovery Potential and Scientific Impact*

- Energetic luminous point sources
- WIMP annihilation in the sun or earth
- Acceleration mechanism for hadrons near compact objects
- Energy budget of cosmic rays
- Super-UHE neutrinos above GZK bound
- Exotic particles such as magnetic monopoles, strange quark matter
- Unexpected phenomenon possible due to unique properties of neutrino

### *Precision*

- Atmospheric neutrinos: flux  $\sim 1\%$ , energy spectrum  $\sim 10\%$
- Non-terrestrial neutrinos: sensitivity to  $< 1 \times 10^{(-8)}/\text{GeV}^{(-2)}\text{s}^{(-1)}\text{sr}^{(-1)}$

## Features

### *Detector/Facility*

- To be constructed at South Pole Station, Antarctica

### *Techniques and Type of Detector*

- Optical Cerenkov detector using deep ice below 1500m
- $\sim 1\text{km}^3$  of sensitive volume
- Deployment by hotwater drill

### *Experimental Characteristics*

- Decentralized architecture uses semiautonomous optical modules
- Waveforms captured and digitized at optical modules @ 3ns scale
- Novel time synchronization methodology uses twisted pairs over km scale

## Technological Challenges (if any)

### *R&D Challenges*

- Detector technology established; no serious issues.
- Calibration methodology still not completely established.

### *Construction Challenges*

- Short summer season at pole limits deployment schedule

### *Computing Challenges*

- Transport of data from pole to northern hemisphere.

## LBNL Contribution and Interest

### *Hardware, Software*

- DAQ concept, design, and fabrication
- DAQ software design, and most of implementation
- Data Handling design and implementation

### *Expected or necessary LBNL Manpower*

- 3 Senior staff - physicists
- 3 - 4 Computer Science professionals
- 2 - 3 Post-doctoral physicists
- 1 Senior electrical engineer

- 3 Electrical engineers
- 2 - 3 Graduate students

*Divisions involved*

- Physics
- Nuclear Science
- Engineering
- Computing Science

*Lead of Experiment*

- Francis Halzen, PI, UW
- Bob Stokstad, LBNL

*Proponent*

- We proposed technical design for DAQ..... (not clear what is intended here)

*Participant*

- (not clear what is intended here)

**Status**

- "Phase 1 R&D" support by NSF, in FY02. (\$15M)
- R&D or project funding expected to continue into FY03.
- Full construction funding expected in FY04.

**Timeline**

*Timescale*

- Full construction expected to start in FY04
- Finish construction expected by FY07 or FY08
- Operational lifetime of 5 - 10 years, after construction

*Milestones*

- Cooperative Agreement between UW and NSF signed in August 2002
- Complete "Enhanced Hot water Drill" in FY03
- Complete ~24 digital Optical Modules in FY03

*Duration of Experiment*

- Operational lifetime of 5 - 10 years, after construction

**Location**

South Pole station, Antarctica

**Collaboration**

*Major institutions involved*

- LBNL, Wisconsin, Penn State, UCB, Stockholm, DESY,

**Funding Sources**

- NSF, Germany, Belgium, Sweden

**Resources, Links, and References**

*Websites*

[www.icecube.wisc.edu](http://www.icecube.wisc.edu)

*Preprints*

*Proposals*

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